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VBPA

Comparison of bovine spongiform encephalopathy risk factors in the United States and Great Britain

Kevin D. Walker, PhD; William D. Hueston, DVM, PhD; H. Scott Hurd, DVM, PhD; John W. Wilesmith, BVSc

Bovine spongiform encephalopathy (BSE) was first described in Great Britain in 1986.[1] This new disease, the first subacute transmissible spongiform encephalopathy identified in cattle, is postulated to be the bovine equivalent of the sheep scrapie agent.[2]

The BSE epizootic accumulated over 30,000 cases in Great Britain by the end of June 1991, with exported British cattle also succumbing in Northern Ireland,[3] Oman,[3] and the Republic of Ireland. Additional cases in native cattle have been diagnosed in the Channel Isles and Isle of Man,[4] France,[5] Northern Ireland,[3] the Republic of Ireland,[6] and Switzerland.[7]

Cases of BSE have not been confirmed in the United States, although an outbreak of transmissible mink encephalopathy has been putatively attributed to a scrapie-like infection in cattle by Marsh.[8] Nevertheless, scrapie disease exists in US sheep, raising concern over the potential for development of BSE in native US cattle.[9]

The purpose of this report was to quantify, compare, and assess risk factors in the United States with BSE risk factors in Great Britain. This includes identification and discussion of potential routes of introduction and transmission of BSE in the United States. Also addressed is the role of risk assessment in understanding diseases such as BSE.

BSE epidemiologic findings in Great Britain

The clinical expression of BSE is a central nervous system disorder with marked similarities to subacute transmissible spongiform encephalopathies in other species.[2] Increased apprehension, ataxia, gait abnormalities, loss of body weight, reduced milk production, and hypersensitivity are the most common signs.

Over 97% of the BSE cases have developed in dairy cattle or dairy crossbreeds. The average age at onset is 4 to 5 years.[2] Breed or gender predisposition has not been found. Examination of records of affected herds revealed cattle with similar clinical signs in 1985. The development of BSE was sporadic prior to midyear 1986 when the observed incidence increased substantially.

On the basis of the initial BSE investigations, the exposure began between 1981 and 1982.[2] The epizootic curve matched that of an extended common source exposure. Extensive epidemiologic inquiries implicated the feeding of rendered animal proteins as the source of exposure after no common case links were detected for vaccines, pharmaceuticals, pesticides, or insecticides, or other management factors. To date, no horizontal transmission has been documented. A single case of putative maternal transmission has been reported.

The onset of exposure to the BSE agent was temporally related to two rendering process changes: the adoption of a continuous manufacturing process, and the cessation of hydrocarbon solvent extraction of fat from meat and bone meal.[10] These changes in the rendering industry were postulated to increase the survival of the BSE agent in animal protein products that were used in animal feeds. The resulting larger exposure received by cattle ingesting the affected feeds shortened the incubation period and enabled clinical signs to be observed during the lifetime of the cattle. The overrepresentation of dairy cattle in the BSE epizootic apparently resulted from the greater consumption of concentrate feeds by dairy cattle as opposed to that by beef cattle.[11]

The disease BSE is suggested to be the clinical manifestation of the sheep scrapie agent in cattle rather than a new agent or hitherto unrecognized spongiform encephalopathy agent latent in the cattle population. Consequently, the source of the BSE agent seems to have been scrapie-infected sheep. Scrapie is a disease of mature sheep, with high titers of the agent not developing until adulthood, so sheep older than 1 year are the most likely source. Scrapie is widespread in Great Britain and may have been increasing over the past decade.[4]

Meat and bone meal (including rendered ma-

From Animal Health Information Programs, USDA-APHIS, Veterinary Services, 555 S Howes, Fort Collins, CO 80521 (Walker, Hueston, Hurd) and the Epidemiology Unit, Central Veterinary Laboratory, United Kingdom Ministry of Agriculture, Fisheries and Food, New Haw, Weybridge, Surrey KT15 3NB, England (Wilesmith).

[3]Denny OB. Veterinary Services, Department of Agriculture for Northern Ireland, Belfast, Northern Ireland. Personal communication, 1991.

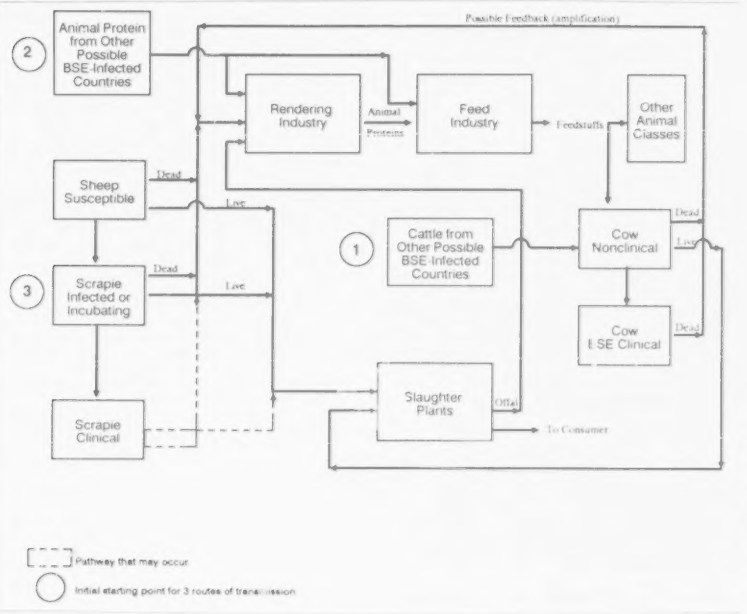

Figure 1—Systems model of hypothesized bovine spongiform encephalopathy epidemiology. Potential routes of transmission in the United States. Source: USDA-APHIS—Veterinary Services.

ture sheep products) has been a common component of cattle feeds in Great Britain[2] as a protein supplement in concentrates for lactating dairy cows as well as starter rations for 1- to 4-month-old calves. Cases of BSE have been confirmed in dairy cattle for which the exposure to meat and bone meal was calf starter rations.[1,2] All cattle with confirmed cases of BSE to date have received meat and bone meal as part of calf starter rations or adult concentrates.

Potential routes of transmission in the United States

The hypothesized transmission of BSE can be diagrammed with a systems model (Figure 1). For the United States, 3 possible transmission routes are represented: imported cattle carrying BSE, imported meat and bone meal containing the BSE agent, and native cattle infected via consumption of domestically produced meat and bone meal containing infected sheep products.

In the past 10 years, approximately 459 cattle, of which 445 were beef breeds, have been imported into the United States from the United Kingdom and Ireland. Further importation has been cancelled, and clinical cases of BSE have not been identified in imported animals. The potential risk of BSE attributable to imported cattle appears to be small.

The risk of BSE from imported animal protein products to cattle in the United States appears to be small. According to GB export data,[b] from 1982 to 1990, two shipments of animal protein products were sent to the United States; 10.3 tonnes (metric ton) in 1984 and 2 tonnes in 1985. By comparison, domestic animal protein production exceeded 3.3 million tonnes in 1989 alone.

The third route of transmission carries the greatest risk of BSE to cattle in the United States because of similarities in the source, manufacturing process, and use of animal protein products as identified in Great Britain. Cattle feed can be made from rendered sheep products derived from commercial slaughter or from dead, dying, or scrapie-infected sheep. Although the infectious dose is unknown and oral ingestion is not an efficient route of exposure, this appears to be the path of transmission in Great Britain. If cattle are being infected, the agent may be recirculating through the rendering of cattle offal.

In Great Britain, clinical signs of BSE appear to have resulted from an increase in the exposure dose received by cattle subsequent to a large increase in the population and slaughter of sheep relative to cattle, the widespread prevalence and apparent increase of scrapie in sheep, and a change in the rendering process that increased the survival of the scrapie agent in meat and bone meal.

In the United States, the risk of BSE can be qualitatively assessed by evaluating inventory and total production of sheep and beef and dairy animals; geographic location, density, and proximity of various animal species; prevalence and distribution of scrapie in sheep; concentration and product mix of animal offal produced at slaughter; total production and usage of animal protein and feed

[b]Lawrence A. United Kingdom Ministry of Agriculture, Fisheries and Food: Unpublished data, 1991.

products, and the structure, technology, government policies, and economic conditions that may facilitate transmission of the agent.

Comparison of the United States with Great Britain

Sheep industry and demographics—The trends in sheep population for Great Britain (England, Scotland, Wales) and the United States have moved in opposite directions (Figure 2). Since 1980, GB sheep inventories increased 33%, to 40.2 million by 1989.[13] In the United States, sheep inventories decreased from a 1942 peak of 47 million head to 10.9 million head by 1989.[14]

Sheep in Great Britain are distributed across a land area slightly smaller than the state of Oregon. Sheep in the United States are dispersed over a much larger landmass, with 2 regions of concentration; 80% are in the 17 western states, and most of the remaining 20% are clustered in the upper midwestern states.[14]

At 82,000 sheep farms, Great Britain has 10,000 fewer sheep farms than the United States, but almost 4 times as many sheep. Flock size distributions differ markedly. Fifty percent of the US farms are in the smallest category of 1 to 24 head, compared with only 11.5% of GB farms[13,15] (Table 1). Farms with over 1,000 head account for more than half of the sheep in both countries.

Sheep farms in England and Wales (data on Scotland are not available) are more diversified than in the United States. Seventy-two percent of the English and Welsh sheep farms also raise cattle, compared with 38% of US sheep farms.[13,15] These combined farms account for 81% of the sheep and 50% of the cattle in England and Wales, compared with 39% of the sheep and only 4.5% of the cattle in the United States.

The sheep industry is much larger and more dynamic in Great Britain than in the United States. In the past decade, milk quotas and related incentives have encouraged dairy farmers to diversify, and lamb and mutton exports to the European community have increased. As a result, the number of sheep farms and total sheep population have increased. The expansion of sheep production has intensified the traditional movement of breeding stock from the upland areas to the lowlands for crossbreeding schemes, a process known as stratification.[15] In addition, more extensive buying, selling, and movement of sheep occurs within Great Britain to arbitrage price differentials across different areas. The combination of an expanding industry and more movement and marketing may have contributed to the spread of scrapie in the sheep population.

Scrapie prevalence—Scrapie has been recognized in Great Britain since at least 1730.[16] An accurate measurement of the current prevalence is not available. In 1988, on the basis of a voluntary survey, Morgan[17] estimated that a third of the British flocks were affected, with the infected flocks scattered throughout Great Britain. Review of the government-sponsored Veterinary Investigation Diagnostic Analysis (VIDA) database from 1975 to 1990 revealed an increase from 63 to 328 in the number of annual scrapie diagnoses. The proportion of scrapie diagnoses relative to all mature sheep carcass and viscera submissions increased significantly ($P < 0.05$), from 0.041 to 0.250 for the same period. Great Britain currently operates a voluntary sheep health scheme, but only 6 flocks were monitored for scrapie in 1990.[18]

In the United States, scrapie was first reported in Michigan in 1947.[19] A Federal-State Cooperative Scrapie Eradication Program was begun in 1952, and confirmed scrapie-affected flocks were depopulated. In 1983, bloodline traceback and slaughter was adopted as an alternative. The number of identified positive flocks increased substan-

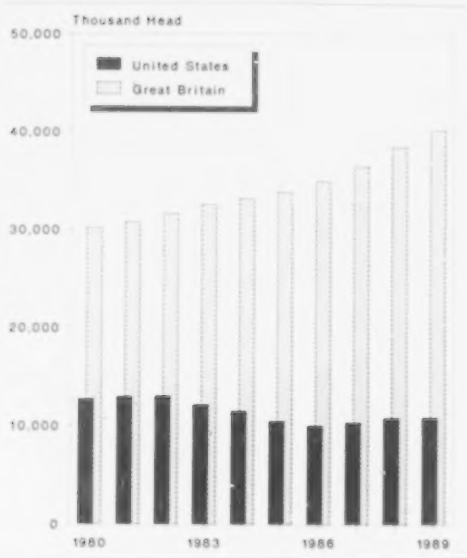

Figure 2—United States and Great Britain sheep inventories from 1980 to 1989. Sources: National Agricultural Statistical Service, USDA, 1980 to 1989, and the Ministry of Agriculture, Fisheries and Food, United Kingdom, 1980 to 1989.

Table 1—United States and Great Britain sheep inventories and operations by flock size in 1989. Sources: National Agricultural Statistical Service, USDA, 1980 to 1989, the Census of Agriculture, United States Department of Commerce, 1975 to 1989, and the Ministry of Agriculture, Fisheries and Food, United Kingdom, 1980 to 1989.

% National inventories		Flock size	% Sheep operations	
Great Britain	United States	(No. of head)	Great Britain	United States
0.3	4.5	1 to 24	11.5	50
2.3	13.5	25 to 99	18.9	34
10.3	14.0	100 to 299	26.2	10
35.0	16.7	300 to 999	29.8	4
52.1	51.3	1000 +	13.6	2

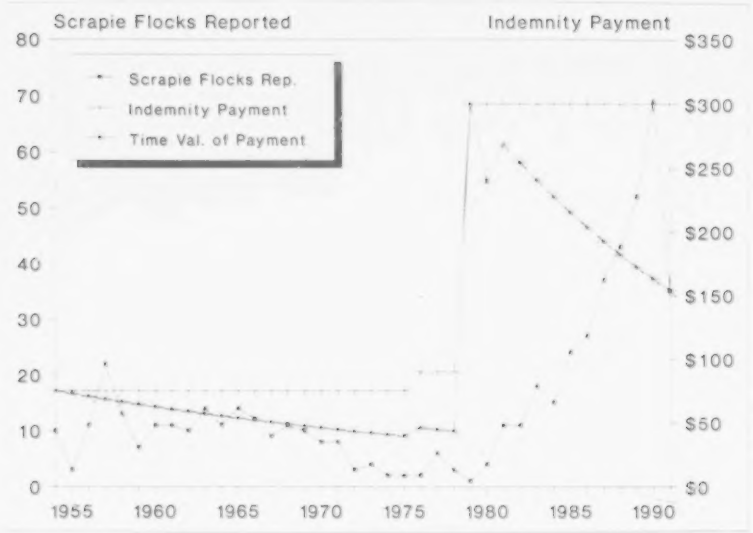

Figure 3—United States scrapie reporting and indemnity payments. Source: USDA-APHIS, 1955 to 1990.

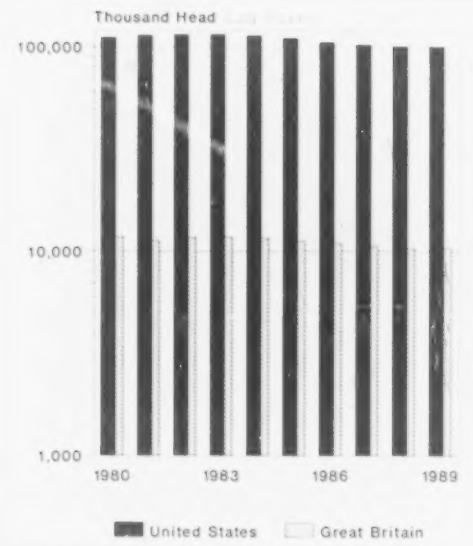

Figure 4—United States and Great Britain cattle inventories from 1980 to 1989. Sources: National Agricultural Statistical Service, USDA, 1980 to 1989, and the Ministry of Agriculture, Fisheries and Food, United Kingdom, 1980 to 1989.

tially in the 1980s. However, a sizeable increase in the indemnity payment in 1979 may explain much of the increase rather than a higher incidence of scrapie (Figure 3). Cumulative reporting of scrapie-infected flocks from 1980 to 1990 amounted to 7.5 of 1,000 flocks infected, with substantial interstate variation. A revised scrapie program is currently being formulated by a joint effort of the sheep industry and government animal health officials.

Although a database equivalent to VIDA does not exist in the United States, the Veterinary Medical Database (VMDB)[5] collects records from the veterinary colleges throughout the United States and can be used to tabulate descriptive statistics on case load and diagnoses. Since 1964, annual scrapie diagnoses recorded by the VMDB have varied from 0 to 9, with 8 diagnoses in 1989. For the five-year period from 1985 to 1989, scrapie diagnoses as a proportion of all sheep examined at the veterinary colleges increased significantly from 0.001 to 0.011 ($P = 0.01$). Diagnoses are disproportionately concentrated in the midwestern region.

Scrapie is endemic in the United States and Great Britain. Scrapie seems to be on the increase in Great Britain as the sheep population increases and sheep are actively moved between premises.[4] An active scrapie control program does not exist in Great Britain. The exact scrapie prevalence in the United States is uncertain, although the number of cases and incidence appears to be lower than in Great Britain, and a scrapie control program is ongoing.

Beef and dairy cattle industries—Both the US and GB cattle populations have decreased during the past decade. At just under 100 million head, the United States still maintains over 9 times more animals than Great Britain (Figure 4). Beef and dairy cattle herds in 1988 numbered 1,176,346 and 202,068 in the United States,[15] compared with 54,334 and 40,858 in Great Britain,[13] respectively.

The US cattle industry is segregated into distinct and separate beef and dairy components with little interaction. The US beef industry consists almost exclusively of beef breeds and beef crossbred cattle, and relies heavily on concentrate

[5]Weirich W. Veterinary Medical DataBase Program, Purdue University, West Lafayette, Ind. Unpublished data, 1990.

feeding for the fattening of steers and heifers for slaughter. More than 75% of all cattle slaughtered pass through a feedlot.

The GB beef and dairy industries are much more integrated. Roughly two thirds of slaughter cattle originate from dairy herds. Dairy crossbred calves are an important source of brood cows and steers for beef production. The beef industry is extensively managed; cattle are fattened on grass pasture over a longer period of time and relatively few animals enter feedlots.

The number of dairy cattle in both countries has decreased. The current US dairy population is 10.1 million head, compared with 2.6 million in Great Britain. Average herd size in the United States is larger than in Great Britain, with 24% of US dairy cattle in herds of 200 or more head, compared with only 10% of GB cattle. Dairy cows are culled at younger ages in the United States. Less than half (46%) of the US dairy cows are 4 years old or older,[d] compared with 70% of GB dairy cows. The average age of US dairy cows is 3.8 years, compared with 5.1 years in Great Britain.

Productivity in the US dairy industry continues to increase. The average dairy cow consumes 2.6 tonnes of concentrate feed per year and produces 6,461 liters of milk.[14] Dairy cattle are bred predominantly by artificial insemination, using dairy breed bulls. Surplus bull calves are sold for veal production.

Dairy productivity trends in Great Britain have declined in the last 10 years because of changes in the economic community's agricultural policies, including the imposition of milk quotas. Concentrate feeding has fallen by one half to about 1 tonne/head/yr. Average milk production per cow has also decreased from 5,076 liters in 1982 and 1983 to 4,923 liters in 1989.[20] Beef bulls are used as a regular part of dairy breeding programs. The sale of dairy crossbred animals (bulls and heifers) represents an important source of income for GB dairy farmers.

Differences in the GB and US beef and dairy cattle industries have direct implications for BSE. Feedlot steers in Great Britain have not had BSE, presumably because these cattle do not live long enough to show clinical signs of disease even if exposed. This suggests a low risk for US feedlot animals. The cases of BSE observed in beef herds are predominantly in purchased dairy crossbred cattle, exposed to meat and bone meal as calves on dairy farms prior to relocating to beef herds. The GB dairy cattle are exposed to meat and bone meal as calves and to dairy concentrate rations as adults. These dairy cows have a longer herd life and may not proceed as quickly to slaughter as in the United States. Some of the cull GB dairy cows enter the beef industry as suckling cows. An estimated 5 to 7% of all brood cows in beef herds are cull dairy cows.[e] If exposure has occurred, the longer age span increases the likelihood of developing clinical signs of BSE.

Slaughter industry—The US slaughter industry is more concentrated than that in Great Britain, with specialized single-species plants accounting for a higher proportion of total production. In 1989, eleven of the 4,500 US slaughter plants, each slaughtering more than 100,000 head, accounted for over 80% of the total lamb slaughter. Twenty-four plants, each slaughtering more than 3,000 head, accounted for over 80% of the total mature sheep slaughter.[21] In Great Britain, sheep slaughter is more dispersed among the 850 slaughter plants, with most plants accepting sheep, cattle, and swine as supplies and market conditions dictate.

In 1989, the US slaughter industry produced 10.48 million tonnes of beef and 157,900 tonnes of lamb and mutton,[22] compared with 880,000 tonnes of beef and 348,300 tonnes of lamb and mutton[b] in Great Britain, respectively. The GB mature sheep slaughter is 5 times higher than that in the United States, whereas the US cattle slaughter is over 12 times that in Great Britain.

The concentration of the US mature sheep slaughter industry suggests that raw materials for rendering may be amassed at several specific sites rather than dispersed throughout the country as in Great Britain. However, total cattle slaughter, in terms of tonnes of beef produced, is 66.4 times greater than the total sheep slaughter in the United States, compared with a ratio of only 2.5 in Great Britain.

Rendering industry—The US and GB rendering industries have moved from a batch process to a more efficient and less resource-intensive continuous process. The transition in the United States began in the early 1970s, with continuous processing now used in all but a few large poultry renderers. The shift in Great Britain occurred in the mid 1970s, with only about 30 small renderers still using the batch method today. The continuous process accounts for approximately three quarters of Great Britain's total output. A second major change in Great Britain was the virtual discontinuance of solvent extraction in the rendering process. A market acceptance of higher fat content allowed the phaseout by the early 1980s.[10] Solvent extraction was never practiced widely in the United States and was discontinued by most renderers more than 30 years ago.[21]

One segment of the GB rendering industry not typical in the United States is the knacker industry. Knackers specialize in the collection of dead, diseased, or injured animals not fit for human con-

[d]Norman D. Animal Improvement Production Laboratory, Agricultural Research Service, USDA. Unpublished data, 1990.

[e]Barnes G. ADAS Livestock Services, Ministry of Agriculture, Fisheries and Food, Wolverhampton, United Kingdom: Personal communication, 1990.

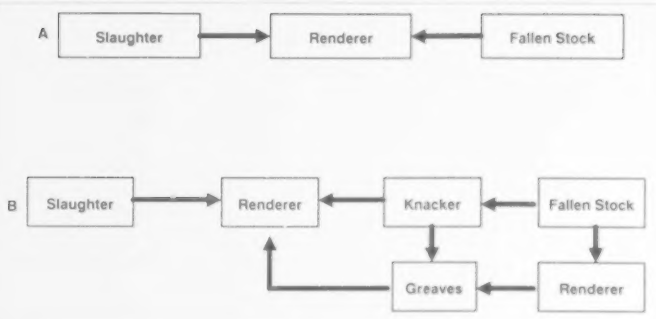

Figure 5—United States (A) and Great Britain (B) rendering industry structure.

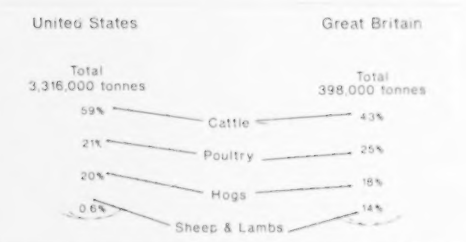

Figure 6—United States and Great Britain rendered animal protein estimated species composition in 1989. Source: USDA-APHIS, 1989.

sumption (Figure 5).[23] Operating throughout Great Britain, coverage has been efficient. Knackers, in concert with small renderers, produce a solid by-product called greaves by cooking the carcasses to remove the tallow. Greaves are sold as an intermediate product to larger renderers. In the United States, renderers handle the pickup of fallen stock; however, coverage is not as complete as in Great Britain except in areas of high livestock concentrations. Greaves are not manufactured in the United States. In Great Britain, raw materials (including greaves) are moved between renderers to a much greater extent than in the United States, contributing to homogeneity of the product.

Animal protein rendering production, excluding blood, feather, and fish meal, can be estimated on the basis of the total number and by-product yield of all species slaughtered. In the United States, animal protein production is estimated at 3.3 million tonnes versus 398,000 tonnes in Great Britain. Sheep slaughter contributes about 0.6% of the total rendered animal protein in the United States, compared with 14% in Great Britain (Figure 6). The rendered animal proteins are distributed into animal feeds, with approximately 13% entering cattle feed in the United States, compared with 10 to 20% in Great Britain prior to the ban on feeding of rendered animal proteins to ruminants in July, 1988.[24] The concentration of single species slaughter in the United States may create significant differences in the quantities of different raw materials to be rendered across the nation. However, the relative and absolute contribution of sheep raw materials in Great Britain greatly exceeds that in the United States.

Ruminant feed industry—Ruminant feed formulations in the United States and Great Britain are driven by least-cost considerations, subject to nutrient requirements. Although oilseed meals are the primary protein source in US feed formulations, constituents such as soybeans must be imported into Great Britain. Consequently, prior to the GB ban, the portion of all animal protein products used in feed as a percent of all protein products in feed was 6 to 7% more in Great Britain than in the United States. Additional usage of animal proteins was tempered in Great Britain by palatability considerations.

In July 1988, the feeding of ruminant-based protein products to cattle was disallowed. Prior to the ban, important differences existed between the United States and Great Britain as to the amounts and types of cattle feeds that contained meat and bone meal. In the United States, meat and bone meal is routinely incorporated into adult cattle rations. However, it is not believed to be incorporated into US calf starter rations, attributable in part to palatability concerns as well as an abundance of plant-based proteins. In Great Britain, calves were typically fed 25 kg of calf starter with meat and bone meal, blood meal, or a combination thereof, accounting for up to 4% of the formulation. This amounted to roughly 1 kg of meat and bone meal over a 12-week period beginning around 1 month of age.

Qualitative risk assessment for the United States

A comparison of the United States and Great Britain revealed tremendous differences in the size, structure, and conduct of the sheep, beef, and dairy industries (Table 2). Great Britain has a large and active sheep industry but a small cattle industry, whereas the United States has a large cattle industry and a small sheep industry. The relative magnitude of these two industries in each country has a tremendous impact on comparisons of the slaughter and rendering industries. Sheep slaughter and the resultant proportion of mature sheep offal to

Table 2—United States and Great Britain comparison of sheep and cattle populations from 1980 to 1989. Sources: National Agricultural Statistical Service, USDA, 1980 to 1989, and the Ministry of Agriculture, Fisheries and Food, United Kingdom, 1980 to 1989.

Ratio	Great Britain		United States		Great Britain United States	
	1980	1989	1980	1989	1980	1989
All sheep to all cattle	2.6	3.9	0.11	0.11	23.6	35.5
All sheep to all dairy cattle	10.2	15.6	1.2	1.1	8.5	14.2
All sheep >1 year old to all cattle	1.3	1.9	0.08	0.08	16.3	23.8
All sheep > 1 year old to all adult cows	3.7	5.2	0.19	0.17	19.5	30.6
All sheep > 1 year old to all dairy cows	5.3	7.7	0.83	0.74	6.4	10.4

total rendered protein products produced are substantially larger in Great Britain than in the United States.

However, major differences notwithstanding, the United States has all of the necessary factors for BSE; that is, the presence of scrapie in the sheep population, similar rendering technology allowing for the survival of the scrapie agent, and inclusion of meat and bone meal in cattle concentrate feeds. Consequently, evaluation of the relative risk of BSE in the United States utilizes the "effective dose" concept to understand cattle exposure to the scrapie agent.

Effective dose is defined as the amount of exposure necessary to cause clinical signs during an infected animal's lifetime. The incubation period of scrapie is inversely related to the exposure dose.[23] Low exposures are associated with protracted incubation times. The effective dose of the scrapie agent for BSE is hypothesized to be reached when clinical signs begin to appear within the lifespan of the average cow.

In Great Britain, the effective dose concept[10] assumed that the scrapie agent survived the rendering process and was incorporated into cattle feeds for decades prior to the recognition of BSE. Apparently, the appearance of BSE in the mid-1980s resulted from the interaction of at least 3 separate trends: adoption of a continuous rendering process and the cessation of solvent extraction by the rendering industry, the increase in the sheep population relative to cattle populations as the source of raw materials for rendering, and the apparent increase in scrapie along with the active sale and movement of sheep as the overall sheep population grew. The net effect of all of these events was an increase in the exposure dose of scrapie to cattle.

Evaluation of the US risk of BSE suggests that dairy cattle have the greatest risk of exposure to the scrapie agent and development of the clinical disease. Beef brood cows are fed low amounts of concentrates. Feedlot animals typically consume much higher amounts of concentrates but are slaughtered long before the clinical signs of BSE would be evident. A worst-case scenario can be hypothesized as all meat and bone meal from mature sheep being incorporated into dairy concentrate feeds only. For this scenario, a ratio can be calculated to quantify the relative exposure to the scrapie agent by dividing the kilograms of concentrates fed to dairy cattle by the kilograms of mature sheep meat and bone meal produced. The ratio in the United States is 34,760:1, compared with 778:1 for Great Britain. Therefore, the worst-case concentration of scrapie agent in US dairy feeds is 45 times less than the worst-case concentration in Great Britain. After taking into consideration the average concentrate consumption of US and GB dairy cattle, the average US cow would consume 80 g of mature sheep meat and bone meal per year, compared with 1.6 kg in Great Britain. Furthermore, the lack of incorporation of meat and bone meal into calf starter feeds in the United States suggests a later exposure in the average animal's life.

The lower exposure dose, the later time of exposure, and the shorter average lifespan of the US dairy cows decrease the likelihood of seeing clinical signs even if the cattle become infected. Consequently, US dairy cattle appear to be at much lower risk for development of BSE than GB dairy cattle, even under the worst-case scenario.

The role of risk assessment

Two brief risk assessments for BSE in the United States have been done, each targeting a different audience.[2,3,1] On the basis of our qualitative analysis, we reached conclusions similar to those reported by others, that is, the potential risk of a BSE epizootic in the United States on the scale of Great Britain's experience is small.

Although the comparison of risk factors does not identify a broad national risk for a BSE epizootic in the United States, wide regional variations in risk may result for specific areas. The development of sporadic cases of BSE cannot be ruled out. Moreover, further evidence of an increase in scrapie incidence or increased incorporation of meat and bone meal into calf starter rations would necessitate a reconsideration of the risk. Quantitative risk analyses are underway in the USDA to further define high-risk practices and geographic areas within the United States.

Concerns have been raised about the potential of BSE in other countries[26-28]; however, no other formalized national risk assessments have been published. The risk assessment described in this report addresses the aggregate national animal health and is necessarily qualitative, that is, comparing industry structure, demographics, and overall production statistics between the United States and Great Britain. Quantitative risk assessments,

[1]Marsh RF. Risk assessment on the possible occurrence of bovine spongiform encephalopathy in the United States. Presented at the Seminar on Spongiform Encephalopathies organized by the European Commission, Nov 12-14, 1990.

such as the building of models, complement qualitative risk assessment and allow for more specific definition of areas or practices associated with the highest risks.

The ultimate use of the BSE risk assessment is twofold: risk communication and risk management. Risk communication involves educating those potentially affected by BSE so that perceptions of risk can be anticipated and addressed.[29] Risk management directs resources toward the critical points of highest risk of BSE identified through the risk analysis and prepares contingency plans in the event that BSE is identified within the United States.

The USDA-APHIS Veterinary Services is working with other federal and state agencies on risk communication and risk resolution. An extensive education program is underway to acquaint veterinarians with clinical signs of BSE. At the same time, an active surveillance program is being maintained for BSE suspects. Surveillance efforts are being intensified in the areas identified as high risk by the quantitative assessment. The surveillance hinges on the examination of brains from cattle with suspicious neurologic signs, because no diagnostic tests for live animals are currently available. In addition, contingency planning is underway to ensure preparedness in the event of BSE diagnosis.

Private practitioners are a critical component for the early identification of BSE suspects. Veterinarians that observe cattle with clinical signs compatible with BSE are encouraged to contact their nearest state or federal veterinarians for diagnostic support.

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